Selected Abstracts from Other Physical Review Journals

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Quadrupole moments of the halogen nuclei. Heinz Haas, *Bereich Festkörperphysik, Hahn-Meitner-Institut Berlin, D-14109 Berlin, Germany;* Helena M. Petrilli, *Instituto de Fisica da Universidade de São Paulo, Caixa Postal 66318, 05315-970, São Paulo, São Paulo, Brazil.* (Received 14 December 1999)

The nuclear quadrupole moments for the isotopes of Cl, Br, and I were derived from theoretical calculations of the electric-field gradients in the simple diatomic molecules Cl_2, Br_2, and I_2. Two different density-functional methods, the full-potential linearized augmented plane waves and the projector augmented waves techniques were applied with various approximations for the exchange and correlation term. Using quadrupole coupling constants from the literature, the values for the nuclear quadrupole moments obtained are $|Q| = 8.19(11)$, 30.5(5), and 68.9(15) fm^2 for ^{35}Cl, ^{79}Br, and ^{127}I, respectively. Except for Cl the present results deviate considerably from formerly accepted values obtained from atomic spectroscopy. A reanalysis of the quadrupole coupling in the Cl, Br, and I atoms reveals the origin of this discrepancy. [Phys. Rev. B **61**, 13588 (2000)]

Slowing out of equilibrium near the QCD critical point. Boris Berdnikov and Krishna Rajagopal, *Center for Theoretical Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.* (Received 10 December 1999; published 26 April 2000)

The QCD phase diagram may feature a critical end point at a temperature T and baryon chemical potential μ which is accessible in heavy-ion collisions. The universal long wavelength fluctuations which develop near this Ising critical point result in experimental signatures which can be used to find the critical point. The magnitude of the observed effects depends on how large the correlation length ξ becomes. Because the matter created in a heavy-ion collision cools through the critical region of the phase diagram in a finite time, critical slowing down limits the growth of ξ, preventing it from staying in equilibrium. This is the fundamental nonequilibrium effect which must be calculated in order to make quantitative predictions for experiment. We use universal nonequilibrium dynamics and phenomenologically motivated values for the necessary nonuniversal quantities to estimate how much the growth of ξ is slowed. [Phys. Rev. D **61**, 105017 (2000)]

Mass hierarchies and the seesaw neutrino mixing. T. K. Kuo, *Department of Physics, Purdue University, West Lafayette, Indiana 47907;* Guo-Hong Wu, *Institute of Theoretical Science, University of Oregon, Eugene, Oregon 97403;* Sadek W. Mansour, *Department of Physics, Purdue University, West Lafayette, Indiana 47907.* (Received 15 December 1999; published 4 May 2000)

We give a general analysis of neutrino mixing in the seesaw mechanism with three flavors. Assuming that the Dirac and u-quark mass matrices are similar, we establish simple relations between the neutrino parameters and individual Majorana masses. They are shown to depend rather strongly on the physical neutrino mixing angles. We calculate explicitly the implied Majorana mass hierarchies for parameter sets corresponding to different solutions to the solar neutrino problem. [Phys. Rev. D **61**, 111301 (2000)]

Pionic measures of parity and *CP* violation in high energy nuclear collisions. Dmitri Kharzeev, *RIKEN BNL Research Center and Department of Physics, Brookhaven National Laboratory, Upton, New York 11973-5000;* Robert D. Pisarski, *Department of Physics, Brookhaven National Laboratory, Upton, New York 11973-5000.* (Received 16 June 1999; published 11 May 2000)

The collisions of large nuclei at high energies could produce metastable vacua which are odd under parity P, charge conjugation C, and/or CP. Using only the three-momenta of charged pions (or kaons), we show how to construct global observables which are odd under P, C, and CP, and which can be measured on an event by event basis. Model dependent estimates of the P-odd observables are on the order of 10^{-3}. [Phys. Rev. D **61**, 111901 (2000)]

Inelastic J/ψ production in polarized photon-hadron collisions. Feng Yuan, Hui-Shi Dong, and Li-Kun Hao, *Department of Physics, Peking University, Beijing 100871, People's Republic of China;* Kuang-Ta Chao, *China Center of Advanced Science and Technology (World Laboratory), Beijing 100080, People's Republic of China and Department of Physics, Peking University, Beijing 100871, People's Republic of China.* (Received 9 September 1999; revised manuscript 13 December 1999; published 9 May 2000)

We present a calculation of inelastic J/ψ production in polarized photon-hadron collisions. We consider the photoproduction of J/ψ in the energy range relevant to the DESY HERA collider. The Weizsäcker-Williams approximation is adopted in the evaluation of the cross sections for ep collisions. We find that this process can give another independent test for the color-octet mechanism, and the different features for the two color-octet processes may provide further information on the mechanism for inelastic J/ψ photoproduction. The discrepancy in the production asymmetry A between various sets of polarized gluon distribution functions is also found to be distinctive. [Phys. Rev. D **61**, 114013 (2000)]

Gravitational coupling to two-particle bound states and momentum conservation in deep inelastic scattering. Zoltán Batiz, *Department of Physics, College of William and Mary, Williamsburg, Virginia 23185;* Franz Gross, *Department of Physics, College of William and Mary, Williamsburg, Virginia 23185 and Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606.* (Received 17 August 1999; published 10 May 2000)

The momentum conservation sum rule for deep inelastic scattering (DIS) from composite particles is investigated using the general theory of relativity. For two $(1+1)$-dimensional examples, it is shown that covariant theories automatically satisy the DIS momentum conservation sum rule provided the bound state is covariantly normalized. Therefore, in these cases the two DIS sum rules for baryon conservation and momentum conservation are equivalent. [Phys. Rev. D **61**, 114023 (2000)]

Zero mode quantization of multi-Skyrmions. Patrick Irwin, *Groupe de Physique des Particules, Département de Physique, Université de Montréal, C.P. 6128 succ. Centre-Ville, Montréal, Québec, Canada H3C 3J7.* (Received 14 September 1999; published 10 May 2000)

A zero mode quantization of the minimal energy SU(2) Skyrmions for nucleon numbers four to nine and seventeen is described. This involves quantizing the rotational and isorotational modes of the configurations. For nucleon numbers four, six and eight the ground states obtained are in agreement with the observed nuclear states of helium, lithium and beryllium. However, for nucleon numbers five, seven, nine and seventeen the spins obtained conflict with the observed isodoublet nuclear states. [Phys. Rev. D **61**, 114024 (2000)]

Color singlet relativistic correction in J/ψ photoproduction. C. B. Paranavitane and B. H. J. McKellar, *Research Center for High Energy Physics, School of Physics, University of Melbourne, Parkville, Victoria 3010, Australia;* J. P. Ma, *Institute of Theoretical Physics, Academia Sinica, P.O. Box 2735, Beijing 100080, China.* (Received 30 December 1998; revised manuscript received 6 December 1999; published 28 April 2000)

The $O(v^2)$ relativistic correction for inelastic J/ψ photoproduction, in which heavy quark pairs are in the dominant Fock state of the quarkonium, is studied in the framework of NRQCD factorization. An assessment of its significance, particularly in comparison to the color octet contributions, is made. It is found that the impact on the energy distribution is negative in certain regions of phase space. The predictions are compared with photoproduction data from DESY HERA. [Phys. Rev. D **61**, 114502 (2000)]

$1/m_Q$ corrections to the Bethe-Salpeter equation for Λ_Q in the diquark picture. X.-H. Guo, *Department of Physics and Mathematical Physics, and Special Research Center for the Subatomic Structure of Matter, University of Adelaide, Adelaide SA 5005, Australia and Institute of High Energy Physics, Academia Sinica, Beijing 100039, China;* A. W. Thomas, *Department of Physics and Mathematical Physics, and Special Research Center for the Subatomic Structure of Matter, University of Adelaide, Adelaide SA 5005, Australia;* A. G. Williams, *Department of Physics and Mathematical Physics, and Special Research Center for the Subatomic Structure of Matter, University of Adelaide, Adelaide SA 5005, Australia and Department of Physics and SCRI, Florida State University, Tallahassee, Florida 32306-4052.* (Received 30 November 1999; published 11 May 2000)

Corrections of order $1/m_Q$ ($Q=b$ or c) to the Bethe-Salpeter (BS) equation for Λ_Q are analyzed on the assumption that the heavy baryon Λ_Q is composed of a heavy quark and a scalar, light diquark. It is found that in addition to the one BS scalar function in the limit $m_Q\to\infty$, two more scalar functions are needed at the order $1/m_Q$. These can be related to the BS scalar function in the leading order in our model. The six form factors for the weak transition $\Lambda_b\to\Lambda_c$ are expressed in terms of these wave functions and the results are consistent with HQET to order $1/m_Q$. Assuming the kernel for the BS equation in the limit $m_Q\to\infty$ to consist of a scalar confinement term and a one-gluon-exchange term we obtain numerical solutions for the BS wave functions, and hence for the $\Lambda_b\to\Lambda_c$ form factors to order $1/m_Q$. Predictions are given for the differential and total decay widths for $\Lambda_b\to\Lambda_c l\bar{\nu}$, and also for the nonleptonic decay widths for $\Lambda_b\to\Lambda_c$ plus a pseudoscalar or vector meson, with QCD corrections being also included. [Phys. Rev. D **61**, 116015 (2000)]

Memory effects and thermodynamics in strong field plasmas. J. C. R. Bloch, C. D. Roberts, and S. M. Schmidt, *Physics Division, Argonne National Laboratory, Argonne, Illinois 60439-4843.* (Received 28 October 1999; published 9 May 2000)

We study the evolution of a strong field plasma using a quantum Vlasov equation with a non-Markovian source term and a simple collision term, and calculate the time dependence of the energy and number density, and the temperature. The evolution of a plasma produced with BNL RHIC-like initial conditions is well described by a low density approximation to the source term. However, non-Markovian aspects should be retained to obtain an accurate description of the early stages of a CERN LHC-like plasma. [Phys. Rev. D **61**, 117502 (2000)]

Production of J/ψ mesons in pBe collisions at 530 and 800 GeV/c. A. Gribushin,[4] V. Abramov,[2] Yu. Antipov,[2] B. Baldin,[2] R. Crittenden,[4] C. Davis,[5] L. Dauwe,[6] S. Denisov,[2] A. Dyshkant,[2] A. Dzierba,[4] V. Glebov,[2] H. Goldberg,[3] R. Jesik,[4] V. Koreshev,[2] J. Krider,[1] A. Krinitsyn,[2] R. Li,[4] S. Margulies,[3] T. Marshall,[4] J. Martin,[4] H. Mendez,[3] A. Petrukhin,[2] J. Solomon,[3] V. Sirotenko,[2] P. Smith,[4] T. Sulanke,[4] R. Sulyaev,[2] F. Vaca,[3] A. Ziemiński[4] (E672 Collaboration), L. Apanasevich,[9] J. Bacigalupi,[7] M. Begel,[13] S. Blusk,[12] C. Bromberg,[9] P. Chang,[10] B. Choudhary,[8] W. H. Chung,[12] L. de Barbaro,[13] W. Długosz,[10] J. Dunlea,[13] E. Engels, Jr.,[12] G. Fanourakis,[13] G. Ginther,[13] K. Hartman,[11] J. Huston,[9] V. Kapoor,[8] C. Lirakis,[10] S. Mani,[7] J. Mansour,[13] A. Maul,[9] R. Miller,[9] G. Osborne,[13] D. Pellett,[7] E. Pothier,[10] R. Roser,[13] P. Shepard,[12] D. Skow,[1] P. Slattery,[13] L. Sorrell,[9] D. Striley,[10] N. Varelas,[13] D. Weerasundara,[12] C. Yosef,[9] M. Zieliński,[13] and V. Zutshi[8] (E706 Collaboration) [1]*Fermi National Accelerator Laboratory, Batavia, Illinois 60510* [2]*Institute for High Energy Physics, Serpukhov, Russia* [3]*University of Illinois at Chi-*

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We report on the production of J/ψ mesons in 530 and 800 GeV/c pBe collisions in the Feynman-x range $0.0<x_F<0.6$. The J/ψ mesons were detected via decays into $\mu^+\mu^-$. Differential distributions for J/ψ production have been measured as functions of x_F, p_T^2, and the cosine of the Gottfried-Jackson decay angle. These distributions are compared with results on J/ψ production obtained in 515 GeV/c π^-Be collisions, measured by the same experiment, as well as with results from other experiments using incident protons. [Phys. Rev. D **62**, 012001 (2000)]

Erraticity of rapidity gaps. Rudolph C. Hwa and Qing-hui Zhang, *Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403-5203.* (Received 13 December 1999; published 18 May 2000)

The use of rapidity gaps is proposed as a measure of the spatial pattern of an event. When the event multiplicity is low, the gaps between neighboring particles carry far more information about an event than multiplicity spikes, which may occur very rarely. Two moments of the gap distribution are suggested for characterizing an event. The fluctuations of those moments from event to event are then quantified by an entropy-like measure, which serves to describe erraticity. We use ECOMB to simulate the exclusive rapidity distribution of each event, from which the erraticity measures are calculated. The dependences of those measures on the order q of the moments provide single-parameter characterizations of erraticity. [Phys. Rev. D **62**, 014003 (2000)]

Spatial structure of quark Cooper pairs in a color superconductor. Masayuki Matsuzaki, *Department of Physics, Fukuoka University of Education, Munakata, Fukuoka 811-4192, Japan.* (Received 28 October 1999; published 24 May 2000)

The spatial structure of Cooper pairs with quantum number color $\mathbf{3}^*$, $I=J=L=S=0$ in ud 2 flavor quark matter is studied by solving the gap equation and calculating the coherence length in full momentum range without the weak coupling approximation. Although the gap at the Fermi surface and the coherence length depend on density weakly, the shape of the r-space pair wave function varies strongly with density. This result indicates that quark Cooper pairs become more bosonic at higher densities. [Phys. Rev. D **62**, 017501 (2000)]